DOCUMENT RESUME

ED 225 421 HE 015 616

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TITLE The Empirical Impact of the Graduate Record Examination and Grade Point Average on Entry and Success in Graduate School at Texas A&M University.
PUB DATE 18 Feb 81
NOTE 22p.
PUB TYPE Reports - Research/Technical (143)

EDRS PRICE MF01/PC01 Plus Postage.
DESCRIPTORS *Aptitude Tests; *Grade Point Average; *Graduate Students; Higher Education; Intellectual Disciplines; Logical Thinking; Mathematics; *Predictor Variables; Quantitative Tests; Scores; Sex Bias; *Test Bias; Verbal Ability
IDENTIFIERS *Graduate Record Examinations; *Texas A and M University

ABSTRACT

The use of the restructured Graduate Record Examination (GRE), students' entering grade point averages (GPAs), and other variables as predictors of success in graduate school at Texas A&M University (TAMU) was studied. Comparisons were also made to a similar study (Kunze, 1974). A sample of 564 entering graduate students who had taken the restructured GRE was assessed in 1978. Data were collected on the students during their first two semesters in graduate school at TAMU. Significant correlations of entering GPA to GRE verbal and quantitative and analytic scores were found in the colleges of architecture, business administration, and engineering. Significant correlations between entering and current GPAs were found in the colleges of architecture, business administration, education, engineering, geosciences, and science. At the master's level, the GRE was not significantly predictive for any scales in the colleges of education, engineering, geosciences, and science, although entering GPA was. Only in architecture were any of the GRE scores significant (i.e., the verbal and analytic scores). For the colleges of agriculture, education, and science, the GRE analytic score was the only significant predictor. It is concluded that the GRE must be considered of questionable usefulness at TAMU as a predictor of success in graduate school. Numerous shifts in relationships noted in 1974 research were found, as were strong elements of sex bias in both the GRE verbal and quantitative scores for TAMU students. For the College of Education, the GRE was not an effective predictor of success at either the master's or doctoral level. (SW)

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ED225421

The Empirical Impact of the Graduate Record Examination and Grade Point Average on Entry and Success in Graduate School at Texas A&M University

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February 18, 1981

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INTRODUCTION

The marked increase in the number of students seeking admission into graduate schools has caused many universities and institutions to question the dependability of present methods for identifying the students who are most likely to be successful in graduate school. The present methods of selection most frequently include some form of the undergraduate record along with some means of determining the quality of the undergraduate institution. Due to the diversity of the institutions, it became necessary to locate some test form that measured previous knowledges and aptitudes of the potentially successful graduate student. Therefore, the Graduate Record Examination (GRE) has become one of the most widely used tests (Lannholm, 1967; 1971).

The GRE has been used as a decision making tool for more than forty years. During that time it has undergone many revisions and restructurings as the result of research conducted by Educational Testing Service (ETS) and many major universities (Lannholm and Schrader, 1951; Lanholm, 1968; 1972; Willingham, 1974). In 1951 the GRE was restructured to include the verbal and quantitative sections that are presently being used by major institutions to aid in the selection of graduate students. The GRE underwent another major restructuring in 1977. At this time the verbal and quantitative sections were revised and shortened and the analytic section was added as a result of studies conducted by ETS and the GRE Board. The new analytic section includes three item types: analytical reasoning, analysis of explanations, and logical diagrams (Wild, 1979). The revised GRE was first given at the October 1977 GRE testing sessions (Educational Testing Service, 1977).

Lannholm (1971) reported in a survey of the members of the Council of Graduate Schools in the United States that 247 of the 288 institutions responding

reported at least one department requiring or recommending that all applicants for admission to graduate study submit one or more GRE scores. Of the 247 institutions only 112 apply the same policy to all departments. Of the 112 only 58 have a graduate-school-wide policy requiring a specific minimum GRE score. These requirements or recommendations vary from graduate school to graduate school with many setting minimum standards that may vary from department to department within the graduate school.

Numerous graduate schools have chosen only to recommend the use of the GRE rather than require it based on admitted biases within the test that cause the aptitudes and abilities of certain groups of students not to be measured effectively. The GRE Board has been conducting research studies to explore the problem of 'social justice' of the GRE (Crawford, 1972). The GRE Board stated that the GRE has an intrinsic cultural bias which makes it unfair to minorities as well as women (Crawford, 1972). Other studies conducted on the GRE have found that the GRE has very little predictive validity for specialized groups. Borg (1963) found that the GRE has little predictive validity for a relatively unrestricted sample of graduate students in education. Madaus and Walsh (1965) found that the GRE scores are inefficient predictors of success in graduate school. Lannholm (1968) in a summary of studies between the years 1952 and 1967 utilizing the GRE scores found that the GRE should be used as a supplement to other data such as undergraduate records and recommendations, since the effectiveness of GRE test scores is judged by how well they improve prediction.

The concerns being expressed by many universities across the nation were not unnoticed at Texas A&M University (TAMU). The Graduate College under the direction of G.W. Kunze initiated an investigation of the GRE and grade point ratios (GPR) and their uses at TAMU in 1974. The study conducted by Cartwright

and Kunze (1974) states:

> There can be little doubt that both EGPR (*entering*) and the TGRE (*total*) have positive but limited general value in predicting success. It is also clear that the value varies according to the college and the degree. The separate use of the VGRE (*verbal*) and the QGRE (*quantitative*) scores tended to improve the value of the GRE. The VGRE emerged as being more useful than the QGRE for the majority of colleges and degrees, but not for all.

Cartwright and Kunze (1974) found that depending on the particular college and degree, it appeared that the GRE and the grade point ratio have been positive aids in the majority of instances, but the magnitude of the correlations strongly suggests that additional supplementary aids should be employed, especially in some colleges. This implies that some other test should be used in addition to the GRE and grade point ratio in some colleges.

Educational Testing Service, after reviewing research conducted within ETS and by many universities, suggested that the GRE (as it stood) needed to be restructured to include a section to measure analytic ability as well as revised sections to measure verbal and quantitative abilities. The additional analytic component and the revised sections of the verbal and quantitative abilities were first given in October 1977 to enable the first students who took the revised GRE to enter universities in 1978. This revision created the problem of determining how to use the new analytic score on the restructured GRE for the purpose of predicting success in graduate school. ETS suggested that each graduate school conduct its own study to determine how it could best utilize the new score in a prediction model.

In 1978 the Graduate College of TAMU followed the suggestion of ETS and initiated an investigation of the restructured GRE and entering grade point average as predictors of success in graduate school. The investigation of the restructured GRE, entering grade point average, and additional predictors of success in graduate school at TAMU is the subject of this paper.

METHODOLOGY

Sample

The sample for this study included all graduate students entering TAMU during the spring, summer or fall semesters of 1978 who had taken the restructured GRE which then included sections to measure analytic ability. Table I presents the sample of 564 students by colleges. In addition, the sample is divided into master's and doctoral students. It was decided that a sample size of at least 15 would be required before a separate analysis of doctoral students by college could be made. Only three colleges met this criteria. Even then caution should be exercised in interpreting findings for a sample size less than 25.

Predictor Variables

A review of the previous literature suggested the use of five major predictor variables. The major predictor variables used in this study were verbal ability, quantitative ability, analytic ability, entering grade point average, and major area of study. Table II presents these major predictor variables in addition to six minor predictor varibles. Each of the predictor variables is operationally defined in Table II.

Criterion Variables

In reviewing previous literature many different measures were used as criterion measures of success in graduate school. The criterion variables used in this study were current grade point average and status in graduate school. Table III presents and operationally defines each of the criterion variables.

Procedures

Data were collected on each of the 564 students in the sample for their first two full semesters in graduate school at TAMU. The data were collected

TABLE I

SAMPLE FOR STUDY

(ALL STUDENTS WHO HAD ENTERED GRADUATE SCHOOL AT TAMU AND HAD TAKEN THE GRE IN 1978)

COLLEGE	TOTAL	MASTER'S	DOCTORAL
AGRICULTURE	166	151	15
ARCHITECTURE	27	27	0
BUSINESS ADMINISTRATION	53	50	3
EDUCATION	61	43	18
ENGINEERING	128	124	4
GEOSCIENCES	31	28	3
LIBERAL ARTS	36	34	2
SCIENCE	42	24	18
VETERINARY MEDICINE	20	16	4
TOTAL	564	479	67

TABLE II

PREDICTOR VARIABLES AND OPERATIONAL DEFINITIONS USED IN STUDY

Predictor Variables	Operational Definitions[1]
Verbal Ability	GRE Verbal Score
Quantitative Ability	GRE Quantitative Score
Analytic Ability	GRE Analytic Score
Entering Grade Point Average	Grade point average for last two years of undergraduate study for students working on master's degree.
	Grade point average for master's program for doctoral students.
Major Area of Study	Students divided into nine colleges then colleges are divided into departments
Type of Master's Program	Eleven types of master's degrees are offered
Type of Doctoral Program	Four types of doctoral degrees are offered
Quality of Institution	Selectivity rating; highest degree granted; source of support
Undergraduate Degree at TAMU or Elsewhere	Undergraduate degree received from TAMU or other university
Graduate Degree at TAMU or Elsewhere	Graduate degree received from TAMU or other univeristy
Years Between Degrees	Number of years between completion of last previous degree and beginning of graduate work on present degree

[1]All information from Graduate College records except Quality of Institution (J. Cass and M. Birnbaum, Comparative Guide to American Colleges, 1977.)

TABLE III

CRITERION VARIABLES AND OPERATIONAL DEFINITIONS USED IN STUDY

Criterion Variables	Operational Definitions
Success in Graduate School	
Current Grade Point Average	Grade point average in first year of graduate work on specified degree
Status in Graduate School	Student continues into the third full semester, finishes degree or fails to continue graduate study

with the cooperation of the Graduate College of TAMU by providing access to the official records but keeping the identity of each student confidential. Each student was assigned a number and that number was used thereafter for analytical purposes.

Statistics

Pearson product-moment correlations or nonparametric equivalents were used to determine if a relationship existed between any two of the given variables. In addition, probability values were established for all correlations in order to determine statistical significance.

Multiple regression was used to find out which combination of variables acted as the best predictors of success by accounting for the most variance in the model being tested. Tests of significance were carried out on each of the models used.

FINDINGS

Question 1:

What are the correlations of graduate grade point average to GRE scores and entering grade point average?

Table IV contains the correlations of grade point average to GRE Verbal and GRE Quantitative and entering grade point average as reported by Cartwright and Kunze (1974). Table V presents the findings of the current research of correlations of grade point average to GRE Verbal and GRE Quantitative and GRE Analytic and entering grade point average. In the 1974 study significant correlations were found between grade point average and GRE Verbal for six colleges. The current study found only three significant correlations in the colleges of Architecture, Business Administration and Engineering.

In the relationship of GRE Quantitative to grade point average, the 1974 study found two significant relationships while the current study found significant relationships in the colleges of Agriculture, Architecture, Engineering and Veterinary Medicine. Entering grade point average was found to be significantly correlated with current grade point average in the 1974 study in six colleges. The current study found significant correlations in the colleges of Architecture, Business Administration, Education, Engineering, Geosciences and Science.

In regard to the College of Education, the 1974 study found significant correlations with current grade point average and GRE Verbal and entering grade point average. The current study found no significant correlation with any of the GRE variables and significant correlations with only entering grade point average.

TABLE IV

INTERCORRELATIONS OF CURRENT GRADE POINT AVERAGE TO MAIN PREDICTOR VARIABLES BY COLLEGES[1]

COLLEGE	GRE VERBAL SCORE	GRE QUANTITATIVE SCORE	ENTERING GRADE POINT AVERAGE
Agriculture	.21**	.23**	.33**
Architecture	.23**	-.06	.11
Business Administration	.06	.06	.15
Education	.27**	-.03	.18**
Engineering	.22**	.24**	.25**
Geosciences	.22	.18	.48**
Liberal Arts	.22*	-.12	.18*
Science	.24**	.15	.30**
Veterinary Medicine	-.06	.07	.27
Total Graduate College	.20**	.09**	.23**

*<.05 **<.01

[1]Data taken from Cartwright, T.C. and Kunze, G.W., The Use of Grade Point Ratios (GPR) and Graduate Record Examination (GRE) Scores as Predictors of Success in Graduate Studies at Texas A&M University. Unpublished report, Texas A&M University, March 25, 1974.

TABLE V

INTERCORRELATIONS OF CURRENT GRADE POINT AVERAGE TO MAJOR PREDICTOR VARIABLES BY COLLEGES

(CURRENT STUDY)

COLLEGE	GRE VERBAL SCORE	GRE QUANTITATIVE SCORE	GRE ANALYTIC SCORE	ENTERING GRADE POINT AVERAGE
AGRICULTURE (N=166)	.29****	.17*	.33****	.36****
ARCHITECTURE (N=27)	-.12	.42*	.43*	-.06
BUSINESS ADMINISTRATION (N=53)	.36***	.12	.34**	.43****
EDUCATION (N=61)	.18	-.10	.13	.29**
ENGINEERING (N=128)	.21**	.19*	.26***	.38****
GEOSCIENCES (N=31)	.14	.10	.09	.37*
LIBERAL ARTS (N=36)	.31	.10	.25	.27
SCIENCE (N=42)	.29	.21	.35*	.47***
VETERINARY MEDICINE (N=20)	.04	.44*	.10	.05
TOTAL GRADUATE COLLEGE (N=564)	.22****	.12***	.25****	.33****

*<.05 **<.02 ***<.01 ****<.001

Question 2:

What percentage of variance can be predicted utilizing the GRE scores, entering grade point average and other predictor variables?

Table VI depicts the percentage of variance accounted for (for variables that were statistically significant) in each of the colleges. The GRE was not significantly predictive for any scales in the colleges of Education, Engineering, Geosciences, and Science at the master's level. In each of these colleges entering grade point average was a significant predictor. Only in Architecture were any of the GRE scores significant. These were the verbal and analytic scores of the GRE.

Table VII provides a parallel presentation of the percentage of variance accounted for by significant variables for the colleges of Agriculture, Education and Science. The GRE analytic score was the only significant predictor in any of the three colleges. Further, entering grade point average was the only significant predictor in Agriculture. A large percentage of variance was accounted for by other factors such as the quality of the previous institution and the type of doctoral program.

Question 3:

To what degree are the current admission variables sexually biased?

Table VIII presents the point-biserial correlations of sex to current grade point average and the GRE variables of verbal, quantitative, and analytic plus entering grade point average. It was found that females are performing significantly better than males throughout the aggregate of colleges. The GRE verbal is significantly biased in favor of females while the GRE quantitative is significantly biased in favor of males.

TABLE VI

PERCENTAGE OF VARIANCE EXPLAINED AT THE MASTER'S LEVEL BY PREDICTORS FOR GRADE POINT AVERAGE

(ONLY SIGNIFICANT VARIABLES SHOWN)

College	GRE Verbal	GRE Quant.	GRE Analytic	Entering GPA	Total All Variables
Agriculture			4	17	22
Architecture*	15		18		52
Business Administration	8			21	33
Education				14	24
Engineering*				13	18
Geosciences				18	23
Liberal Arts*	9				25
Science				34	44
Veterinary Medicine		21			22
TOTAL			2	12	14

*Indicates significant variance across departments in college.

TABLE VII

PERCENTAGE OF VARIANCE EXPLAINED AT THE DOCTORAL LEVEL BY PREDICTORS FOR FOR GRADE POINT AVERAGE

College	GRE Verbal	GRE Quant.	GRE Analytic	Entering GPA	Total All Variables
Agriculture			29	13	50
Education					24
Science					61
TOTAL*			17		25

*Contains data from all 67 doctoral students representing eight colleges.

TABLE VIII

INTERCORRELATIONS OF SEX

TO GRE SCORES AND GPA

(ENTERING AND CURRENT)

(N=564)

CRITERION VARIABLE	CORRELATION*	SIGNIFICANCE
STATUS IN GRADUATE SCHOOL	.02	NS
CURRENT GPA	.13	.001
VERBAL GRE	.15	.001
QUANTITATIVE GRE	-.27	.001
ANALYTIC GRE	.05	NS
ENTERING GPA	.07	NS

*POINT-BISERIAL CORRELATIONS

Question 4:

What will be the impact of establishing a 350 minimum for both the GRE verbal and GRE quantitative scores with a 900 minimum for the combined GRE verbal and quantitative?

Table IX presents the number and percentage of students that would be lost if such a criteria was used. Using all 564 students in the current study, 89 students or 15.8% of the students who were admitted in 1978 would have been excluded from admission. Numerically the largest loss would have been 34 students (20.5%) in the College of Agriculture, while the largest percentage loss, 26.2% (16 students) would have been in the College of Education.

TABLE IX

NUMBER AND PERCENT OF 1978 STUDENTS THAT WOULD HAVE BEEN DENIED ADMISSION WITH NEW CRITERION

College	Total Accepted	Number Dropped	Percent Dropped
Agriculture	166	34	20.5%
Architecture	27	6	22.2%
Business Administration	53	4	7.5%
Education	61	16	26.2%
Engineering	128	19	14.8%
Geosciences	31	1	3.2%
Liberal Arts	36	3	8.3%
Science	42	5	11.9%
Veterinary Medicine	20	1	5.0%
Total Graduate College	564	89	15.8%

CONCLUSIONS

As a predictor of success in graduate school, the GRE must be considered to be of questionable usefulness at TAMU. The results of the current study show numerous shifts in relationships from previous research done in 1974. Further, such diverse patterns exist between colleges at TAMU that each college should develop a unique set of entry level requirements for the purpose of maximizing predictive effectiveness within the respective college and department.

The current empirical findings indicate that for the College of Education the GRE is not an effective predictor of success at either the master's or doctoral level. Additionally,this study has found strong elements of sex bias in both the GRE verbal and GRE quantitative scores for students at TAMU. Caution must be utilized in any measure that discriminates both for and against citizens of Texas.

Finally, the current proposal to utilize minimum criteria for the GRE verbal and quantitative scores at TAMU ignores previous and current research and will continue a policy of setting entry level requirements that are irrelevant to empirical findings and may have the potential of fostering cultural, ethnic, and sexual bias under the guise of improvement of quality.

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